



Roy F Weston, Inc.
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MEMORANDUM

DATE: 3 December 1998

TO: David Bennett, WAM, U.S. EPA, Region X

FROM: Michelle Turner, Chemist, WESTON, Seattle
~~Roger McGinnis~~, Senior Environmental Chemist, WESTON, Seattle

SUBJECT: Validation of Inorganics Data
Laboratory Batch:K9805685
Site: Duwamish River

WORK ASSIGNMENT NO.: 46-23-0JZZ

WORK ORDER NO. 4000-019-038-5200-00

DOC. CONTROL NO.. 4000-019-038-AAAK

cc: Bruce Woods, RAP-WAM, U.S. EPA, Region X
Dena Hughes, Site Manager, WESTON, Seattle (memo only)
Kevin Mundell-Jackson, Database Management, WESTON, Seattle

The quality assurance review of fourteen sediment samples, laboratory batch K9805685, collected from the Duwamish River has been completed. The sediment samples were analyzed for inorganics by Columbia Analytical Services of Kelso, Washington using EPA Methods 200, 6010, 6020, and 7000 series as required to achieve detection limit goals. The samples were numbered

98344072	98344073	98344074	98344075	98344076
98344077	98344078	98344079	98344080	98344081
98344082	98344083	98344084	98344085	

Data Qualifications

The following comments refer to the laboratory performance in meeting the quality control criteria described in the technical specifications of the laboratory subcontract. The review

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follows the format described in the U.S. EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA OSWER 9240 1-05-01, February 1994) modified to include specific requirements of the analytical methods.

1. Holding Times

Holding times of 28 days for mercury and six months for other metals (from date of collection to analysis) were established in the project Sampling and Analysis Plan. All samples met holding time criteria.

2. Calibration

a) Initial Calibration

Initial calibration frequencies and QC criteria were met for ICP and ICP/MS analyses.

Mass calibration for all ICP/MS internal standards was within 0.1 atomic mass unit of the true mass. ICP/MS resolution was less than 0.9 amu full width at 10 percent peak height.

b) CRI/CRA Standards

Instrument calibration was verified using low level standards near the project required detection limit.

c) Initial and Continuing Calibration Verification

All inductively coupled plasma (ICP) and ICP/MS results met control limits of 90 to 110 percent recovery (percent R) of the true values for both initial and continuing calibration.

Mercury cold vapor AA (CVAA) results met control limits of 80 to 120 percent recovery (percent R) for both initial and continuing calibration.

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3. Instrument Detection Limits

All instrument detection limits (IDL) for ICP, ICP/MS, and mercury analyses met project requirements specified in the project Sampling and Analysis Plan.

4. Blanks

a) Laboratory Method Blanks

The following analytes were detected in laboratory method blanks.

Blank ID	Analyte	Concentration	Associated Samples
K9805685-MB	Aluminum	6 mg/Kg	98344072 through 98344085
K9805685-MB	Calcium	6 mg/Kg	98344072 through 98344085
K9805685-MB	Lead	0.01 mg/Kg	98344072 through 98344085
K9805685-MB	Magnesium	9 mg/Kg	98344072 through 98344085
K9805685-MB	Nickel	0.12 mg/Kg	98344072 through 98344085
K9805685-MB	Tin	0.6 mg/Kg	98344072 through 98344085

Results for analytes listed above were qualified as undetected (UJ) if concentrations in associated samples were less than five times the concentration present in the blank.

b) Initial Calibration and Continuing Calibration Blanks

The following elements were found in calibration blanks

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Blank ID	Analyte	Concentration	Associated Samples
CCB2	Nickel	0.06 µg/L	98344076 through 98344084
CCB3	Nickel	0.02 µg/L	98344085
CCB4	Thallium	0.006 µg/L	none

Results for analytes are qualified as undetected (UJ) if concentrations in associated samples are less than five times the concentration present in the blank. As all sample concentrations were greater than five times the blank concentrations, no qualifiers were assigned based on blank results.

c) Field Blanks

No field blank samples were associated with this laboratory batch.

5 ICP and ICP/MS Interference Check

All analytes for the interference check samples were within the control limits of 80 to 120 percent of the true values. Internal standard intensities for analytes determined by ICP/MS were within ± 20 percent of the initial calibration intensity.

6. Laboratory Control Sample

Laboratory control sample recoveries were within the control limits (P-project, L-laboratory) for all analytes except the following:

Analyte	% Recovery	QC Limit
Antimony	67	80-120 (P) 24-176 (L)
Iron	74	80-120 (P) 58-142 (L)

Results and detection limits for the above elements were qualified as estimated (J). Recoveries for Antimony and Iron were below the lower project QC limit, indicating potential low bias. Undetected results for these elements are also qualified as estimated (UJ).

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7 Laboratory Duplicate Sample Analysis

All relative percent differences (RPD) between analytical results were within the QC limit of 35 percent (or ± 2 times the quantitation limit for concentrations < 5 times the quantitation limit).

8 Spiked Sample Analysis

The matrix spike recoveries for the following analytes were outside QC limits:

Sample	Analyte	Percent Recovery	QC Limits
98344072MS	Antimony	26	75-125

In addition, as the native sample concentrations for aluminum and iron exceeded the spike concentration by more than 4 times, recoveries were not calculated. Data were not qualified solely on matrix spike results.

9. ICP and ICP/MS Serial Dilution

Serial dilutions were not performed for this SDG.

10 ICP/MS Quality Control

a) Duplicate Analysis

Duplicate analyses were not performed for this SDG.

b) Post Digest Spike Recovery

Post digest spikes were not performed for this SDG

c) Method of Standard Additions

No samples required MSA analysis

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d) ICP/MS Internal Standards

The intensity of all internal standards was within limits of 30 to 120 percent of the initial calibration intensity for all samples.

10. Field Duplicate Analysis

Samples 98344080 and 98344081 were field duplicates. The RPDs between duplicate results were less than the QC limit of 35 percent for all analytes greater than five times the reporting limit with the following exceptions:

Analyte	Initial Result	Duplicate Result	% RPD
Calcium	4970 mg/Kg	7490 mg/Kg	40

Results for the analytes listed above were qualified as estimated (J) in the field duplicate samples

12. Sample Analysis

A cursory raw data review was performed. All laboratory deliverables were present and complete. The case narrative indicated that the MS recovery of antimony for sample 98344072 was outside the QC limits because of suspected matrix interference. The LCS recovery was within the limits, so no further corrective action was taken. The MS recoveries of aluminum and iron in sample 98344072 were not calculated as the analyte concentrations in the sample were significantly higher than the added spike concentration. Because of the high analyte levels, accurate evaluation of the spike recovery was not possible. No other problems were noted.

13. Laboratory Contact

No laboratory contact was required

Data Assessment

Upon consideration of the data qualifications noted above, the data are ACCEPTABLE for use except where flagged with data qualifiers that modify the usefulness of the individual values.

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Data Qualifiers

- U - The material was analyzed for, but was not detected.
- UJ - The analyte was not detected. The associated quantitation limit is an estimate because quality control criteria were not met.
- J - The analyte was positively identified, but the associated numerical value is an estimated quantity because quality control criteria were not met or because concentrations reported were less than the CRDL or lowest calibration standard
- R - Quality control indicates that data are unusable (compound may or may not be present). Resampling and reanalysis are necessary for verification.

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344072	Units	mg/Kg (ppm)
Lab Code	K9805685-001	Basis	Dry
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	19700	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	1045J
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	13 1	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	116	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 41	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 39	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	5710	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	28	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	9	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	59	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	28600	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	33 0	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	7690	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	312	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 15	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	20 7	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	2600	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	5	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 37	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	10400	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 12	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	4	
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	59	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	111	

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344073	Units	mg/Kg (ppm)						
Lab Code	K9805685-002	Basis	Dry						
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	11600	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	100J
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	8 7	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	1100	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 24	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 51	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	5100	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	23	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	7	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	39	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	17700	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	29 4	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5260	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	179	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 11	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	16 3	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1500	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	3	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 45	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	6280	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 11	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	6	
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	44	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	86	

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344074							Units Basis	mg/Kg (ppm) Dry
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	17400	J
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	6	
Arsenic	EPA 3050B	200 8	0.5	0.1	10	9/3/98	9/18/98	14.6	
Barium	EPA 3050B	6010B	1	0.6	2	9/3/98	9/17/98	118	
Beryllium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.37	
Cadmium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.39	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	6180	
Chromium	EPA 3050B	6010B	2	0.7	2	9/3/98	9/17/98	29	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	8	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	63	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	29000	J
Lead	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	41.0	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	8200	
Manganese	EPA 3050B	6010B	1	0.4	2	9/3/98	9/17/98	291	
Mercury	7471A	7471A	0.05	0.02	1	9/9/98	9/10/98	0.14	
Nickel	EPA 3050B	200 8	0.2	0.02	10	9/3/98	9/18/98	21.6	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	2400	
Selenium	EPA 3050B	200 8	1	0.3	10	9/3/98	9/18/98	5	
Silver	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	0.41	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	11800	
Thallium	EPA 3050B	200 8	0.02	0.006	10	9/3/98	9/18/98	0.12	
Tin	EPA 3050B	200 8	2	0.05	10	9/3/98	9/18/98	6	
Vanadium	EPA 3050B	6010B	2	0.6	2	9/3/98	9/17/98	57	
Zinc	EPA 3050B	6010B	2	0.8	2	9/3/98	9/17/98	134	

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344075	Units	mg/Kg (ppm)						
Lab Code	K9805685-004	Basis	Dry						
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	25100	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	1000
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	11 9	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	113	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 48	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 35	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	6140	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	32	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	11	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	61	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	34300	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	30 2	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	9290	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	359	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 17	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	26 1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	3000	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	5	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 32	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	11700	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 13	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	3	
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	72	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	113	

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Date

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344076	Units	mg/Kg (ppm)
Lab Code	K9805685-005	Basis	Dry
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	10100	100%
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	
Arsenic	EPA 3050B	200 8	0.5	0.1	10	9/3/98	9/18/98	8.5	
Barium	EPA 3050B	6010B	1	0.6	2	9/3/98	9/17/98	53	
Beryllium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.21	
Cadmium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.24	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	7580	
Chromium	EPA 3050B	6010B	2	0.7	2	9/3/98	9/17/98	15	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	31	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	18600	J
Lead	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	20.7	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	4640	
Manganese	EPA 3050B	6010B	1	0.4	2	9/3/98	9/17/98	168	
Mercury	7471A	7471A	0.05	0.02	1	9/9/98	9/10/98	0.07	
Nickel	EPA 3050B	200 8	0.2	0.02	10	9/3/98	9/18/98	15.1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1300	
Selenium	EPA 3050B	200 8	1	0.3	10	9/3/98	9/18/98	2	
Silver	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	0.18	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	6120	
Thallium	EPA 3050B	200 8	0.02	0.006	10	9/3/98	9/18/98	0.05	
Tin	EPA 3050B	200 8	2	0.05	10	9/3/98	9/18/98	3	
Vanadium	EPA 3050B	6010B	2	0.6	2	9/3/98	9/17/98	33	
Zinc	EPA 3050B	6010B	2	0.8	2	9/3/98	9/17/98	77	

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JC

Date

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344077	Units Basis	mg/Kg (ppm) Dry						
Lab Code	K9805685-006								
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	7850	(J)
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	5	
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	4 6	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	42	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 16	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 22	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	8820	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	12	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	4	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	25	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	13100	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	12 2	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	3440	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	125	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 06	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	11 1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1100	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	3	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 33	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	4340	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 05	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	2	WT
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	29	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	51	

Approved By

IS44Inc/031695

05685ICP GJ1 Sample (6) 9/21/98

Date

9/22/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344078	Units	mg/Kg (ppm)						
Lab Code	K9805685-007	Basis	Dry						
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	18600	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	10uJ
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	11 1	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	73	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 38	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 47	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	5400	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	25	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	8	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	47	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	26000	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	26 6	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	7100	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	256	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 18	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	21 1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	2600	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	5	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 43	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	10800	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 13	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	3	
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	59	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	85	

WTW/JL/98

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IS44mc/01695

05685ICP GJ1 Sample (7) 9/21/98

JK

Date

9/22/98

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Page No

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344079	Units	mg/Kg (ppm)
Lab Code	K9805685-008	Basis	Dry
Test Notes			
Analyte	Prep Method	Analysis Method	
Aluminum	EPA 3050B	6010B	10
Antimony	EPA 3050B	6010B	10
Arsenic	EPA 3050B	200 8	0 5
Barium	EPA 3050B	6010B	1
Beryllium	EPA 3050B	200 8	0 02
Cadmium	EPA 3050B	200 8	0 02
Calcium	EPA 3050B	6010B	10
Chromium	EPA 3050B	6010B	2
Cobalt	EPA 3050B	6010B	2
Copper	EPA 3050B	6010B	2
Iron	EPA 3050B	6010B	4
Lead	EPA 3050B	200 8	0 02
Magnesium	EPA 3050B	6010B	2
Manganese	EPA 3050B	6010B	1
Mercury	7471A	7471A	0 05
Nickel	EPA 3050B	200 8	0 2
Potassium	EPA 3050B	6010B	400
Selenium	EPA 3050B	200 8	1
Silver	EPA 3050B	200 8	0 02
Sodium	EPA 3050B	6010B	20
Thallium	EPA 3050B	200 8	0 02
Tin	EPA 3050B	200 8	2
Vanadium	EPA 3050B	6010B	2
Zinc	EPA 3050B	6010B	2
		MRL	MDL
		Dilution Factor	Date Extracted
		Date Analyzed	Result
		Notes	

Approved By _____

1S44mc/031695

05685ICP GJ1 - Sample (8) 9/21/98

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Date

*9/22/98***00014**

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344080	Units	mg/Kg (ppm)					
Lab Code	K9805685-009	Basis	Dry					
Test Notes								
Analyte	Prep Method	Analysis Method	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes	
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	15100
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND 100J
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	9 3
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	53
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 32
Cadmum	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 27
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	4970 J
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	18
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	8
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	39
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	21800 J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	26 0
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5680
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	220
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 09
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	14 2
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	2100
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	4
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 22
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	9740
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 09
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	3
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	49
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	81

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 IS44mc/031695
 05685ICP G31 Sample (9) 9/21/98

Date 9/21/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344081	Units	mg/Kg (ppm)
Lab Code	K9805685-010	Basis	Dry
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	14000	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	1005
Arsenic	EPA 3050B	200 8	0.5	0.1	10	9/3/98	9/18/98	10.0	
Barium	EPA 3050B	6010B	1	0.6	2	9/3/98	9/17/98	61	
Beryllium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.31	
Cadmium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.29	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	7490	J
Chromium	EPA 3050B	6010B	2	0.7	2	9/3/98	9/17/98	17	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	7	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	39	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	21500	J
Lead	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	20.2	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5600	
Manganese	EPA 3050B	6010B	1	0.4	2	9/3/98	9/17/98	215	
Mercury	7471A	7471A	0.05	0.02	1	9/9/98	9/10/98	0.09	
Nickel	EPA 3050B	200 8	0.2	0.02	10	9/3/98	9/18/98	14.1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	2000	
Selenium	EPA 3050B	200 8	1	0.3	10	9/3/98	9/18/98	4	
Silver	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	0.23	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	9330	
Thallium	EPA 3050B	200 8	0.02	0.006	10	9/3/98	9/18/98	0.08	
Tin	EPA 3050B	200 8	2	0.05	10	9/3/98	9/18/98	3	
Vanadium	EPA 3050B	6010B	2	0.6	2	9/3/98	9/17/98	45	
Zinc	EPA 3050B	6010B	2	0.8	2	9/3/98	9/17/98	74	

W.M. J.W. 9/22/98

Approved By

IS44anc/031695

05685ICP GII - Sample (10) 9/21/98

JK

Date

9/22/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344082	Units	mg/Kg (ppm)						
Lab Code	K9805685-011	Basis	Dry						
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	12500	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	1000
Arsenic	EPA 3050B	200 8	0.5	0.1	10	9/3/98	9/18/98	9.9	
Barium	EPA 3050B	6010B	1	0.6	2	9/3/98	9/17/98	50	
Beryllium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.27	
Cadmium	EPA 3050B	200 8	0.02	0.02	10	9/3/98	9/18/98	0.28	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	4060	
Chromium	EPA 3050B	6010B	2	0.7	2	9/3/98	9/17/98	18	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	6	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	38	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	19800	✓
Lead	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	21.2	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5160	
Manganese	EPA 3050B	6010B	1	0.4	2	9/3/98	9/17/98	218	
Mercury	7471A	7471A	0.05	0.02	1	9/9/98	9/10/98	0.10	
Nickel	EPA 3050B	200 8	0.2	0.02	10	9/3/98	9/18/98	16.1	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1700	
Selenium	EPA 3050B	200 8	1	0.3	10	9/3/98	9/18/98	4	
Silver	EPA 3050B	200 8	0.02	0.004	10	9/3/98	9/18/98	0.21	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	6960	
Thallium	EPA 3050B	200 8	0.02	0.006	10	9/3/98	9/18/98	0.08	
Tin	EPA 3050B	200 8	2	0.05	10	9/3/98	9/18/98	3.56	
Vanadium	EPA 3050B	6010B	2	0.6	2	9/3/98	9/17/98	42	
Zinc	EPA 3050B	6010B	2	0.8	2	9/3/98	9/17/98	80	

WGT/11/24/98

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IS44me/031695

05685ICP GII - Sample (1) 9/21/98

JF

Date

9/22/98

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Page No

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344083	Units	mg/Kg (ppm)
Lab Code	K9805685-012	Basis	Dry
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	5570	
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	10 UJ
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	5 2	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	21	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 11	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 09	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	3590	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	10	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	3	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	35	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	14500	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	7 54	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	2440	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	144	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 03	J
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	8 7	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	690	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	2	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 09	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	2870	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 04	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	2	UJ
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	25	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	42	

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IS44mc/031695

05685ICP GJ1 - Sample (12) 9/21/98

Date

9/22/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344084	Units	mg/Kg (ppm)						
Lab Code	K9805685-013	Basis	Dry						
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	11200	1000J
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	8 1	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	32	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 24	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 72	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	3600	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	25	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	6	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	26	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	14800	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	32 3	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	4110	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	131	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 10	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	12 3	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1400	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	3	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 24	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	6170	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 08	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	2	UJ
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	39	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	68	

Approved By _____
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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Roy F Weston, Inc
Project: Duwamish River/4000-027-001-2019-38
Sample Matrix: Sediment

Service Request: K9805685
Date Collected: 8/20/98
Date Received: 8/21/98

Total Metals

Sample Name	98344085	Units	mg/Kg (ppm)						
Lab Code	K9805685-014	Basis	Dry						
Test Notes									
Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Aluminum	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	14200	100UJ
Antimony	EPA 3050B	6010B	10	5	2	9/3/98	9/17/98	ND	
Arsenic	EPA 3050B	200 8	0 5	0 1	10	9/3/98	9/18/98	8 0	
Barium	EPA 3050B	6010B	1	0 6	2	9/3/98	9/17/98	45	
Beryllium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 29	
Cadmium	EPA 3050B	200 8	0 02	0 02	10	9/3/98	9/18/98	0 37	
Calcium	EPA 3050B	6010B	10	3	2	9/3/98	9/17/98	4310	
Chromium	EPA 3050B	6010B	2	0 7	2	9/3/98	9/17/98	21	
Cobalt	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	7	
Copper	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	34	
Iron	EPA 3050B	6010B	4	4	2	9/3/98	9/17/98	18800	J
Lead	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	22 2	
Magnesium	EPA 3050B	6010B	2	2	2	9/3/98	9/17/98	5420	
Manganese	EPA 3050B	6010B	1	0 4	2	9/3/98	9/17/98	187	
Mercury	7471A	7471A	0 05	0 02	1	9/9/98	9/10/98	0 11	
Nickel	EPA 3050B	200 8	0 2	0 02	10	9/3/98	9/18/98	15 5	
Potassium	EPA 3050B	6010B	400	400	2	9/3/98	9/17/98	1800	
Selenium	EPA 3050B	200 8	1	0 3	10	9/3/98	9/18/98	4	
Silver	EPA 3050B	200 8	0 02	0 004	10	9/3/98	9/18/98	0 24	
Sodium	EPA 3050B	6010B	20	20	2	9/3/98	9/17/98	7420	
Thallium	EPA 3050B	200 8	0 02	0 006	10	9/3/98	9/18/98	0 08	
Tin	EPA 3050B	200 8	2	0 05	10	9/3/98	9/18/98	2	UJ
Vanadium	EPA 3050B	6010B	2	0 6	2	9/3/98	9/17/98	43	
Zinc	EPA 3050B	6010B	2	0 8	2	9/3/98	9/17/98	79	

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Approved By

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